NOTE XVIII.

THE PTEROPODA [1]) OF THE LEYDEN MUSEUM

BY

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(With plate 7).

The material of Pteropoda in the collection of the Leyden Museum is rather poor and consists only of a few species, one of which, however, is new to science, while others are rarely met with. So I think it to be not wholly destitute of importance to enumerate the different forms, as it gives rise to some remarks on morphology as well as on distribution, which will follow after the systematic part. A large deal of the collection was supplied during the last few years by Mr. P. J. Buitendijk, physician at the Royal Steam-Shipping Company »Nederland", to whom the Museum is indebted for his zealous collecting zoologica, on his periodical travels to the East- and West-Indies and vice-versa. As circumstances, however, allowed him to effect occasional hauls at the surface only, his captures of pelagic animals (at least with respect to Pteropoda) are neither much varied nor do they contain remarkable forms, with the exception of a few cases which will be discussed later on. — Another part of the Pteropod-material was procured, about thirty years ago, by the late captain J. R. Lusink,

1) In a former paper (p. 7) I proposed to use not the term „Pteropoda" any longer, as, according to Boas and Pelseneer, it unites two groups, which really do not belong together and have a polyphyletic origin. Presently, without prejudicing anything about their separate pedigree, I think it more convenient to keep, provisionally at least, the title, firstly because its meaning has become familiar in zoology, and secondly because recent researches (Meisenheimer and Schiemenz) are more or less sceptic about Pelseneer's assertions.

who, during the years 1878—1880, collected some species, also by means of surface nets, in the Atlantic and Indian Oceans.

Furthermore it may be remarked that only Euthecosomata (in the sense of Meisenheimer) are fairly well represented, while Pseudothecosomata (Cymbuliidae as they are generally called) and Gymnosomata are almost wanting; and to my great regret I can contribute scarcely anything to the distribution of these small, but most interesting groups.

A. EUTHECOSOMATA.

Family I. Limacinidae.

Genus 1. *Limacina* Cuvier.

Species 1. *Limacina helicina* Phipps.

Animals:

Greenland, date?, 2 sp.

Probably by acidified alcohol the shells have quite been dissolved.

Species 2. *Limacina inflata* (d'Orbigny).

Animals:

Mediterranean,	date?		some sp.,	Buitendijk.
"	June	'04,	rather common,	"
"	May	'05,	some sp.,	"
"	Decemb.	'05,	"	"
Indian Ocean,	date?	'04,	many sp.,	"
"	February	'04,	"	"
"	May	'05,	rather common,	"
"	January	'06,	many sp.,	"
"	April	'06,	very common,	"
"	August	'06,	"	"
"	Septemb.	'06,	many sp.,	"
"	Novemb.	'06,	"	"
"	March	'07,	"	"
"	July	'07,	"	"
"	(Gulf of Bengal), August	'06,	"	"
"	(Gulf of Aden), Decemb.	'05,	rather common,	"
"	("), August	'06,	many sp.,	"
"	("), March 17,	'07,	"	"

Red Sea,	Septemb. '04, some sp.,	Buitendijk.
"	January '05, "	"
"	May '05, rather common,	"
"	January '06, "	"
"	April '06, "	"
"	August '06, many sp.,	"
"	Novemb. '06, "	"
"	March '07, "	"
Malacca-street,	August '06, "	"
"	Novemb. '06, some sp.,	"
Java-Sea,	Aug.-Sept. '06, "	"
"	Decemb. '06, "	"

Empty shells:

Mediterranean (Pantellaria, 390 fathoms), purchased 1906, H. B. Preston.

Some specimens have the outer lip of the aperture strengthened by a lateral rib, which causes this lip being protracted into a point. At the base of the rib (more or less distinct) and rectangular to it, a similar one is situated, parallel to the outer margin of the aperture. A brown spot on the beginning of the last whorl, just near the inner lip, is very often found, without, however, being invariably combined to the occurrence of the above-noted ribs.

Species 3. *Limacina lesueuri* (d'Orbigny).
(Pl. 7, Figs. 1—3).

Empty shells:

N. Atlantic Ocean, purchased 1907, 24 sp., Sowerby & Fulton.

A number of dead shells of this rather rare species was purchased from Messrs. Sowerby and Fulton, unfortunately without indication of exact locality. As they differ in some respects from former descriptions, I have figured once more the different aspects of the shell in various positions (Pl. 7, figs. 1—3). From these it may be inferred, that the spire is depressed (though, according to Locard [1]), there seems to be some variation in its height), with 5 whorls, that the umbilicus is very broad, that the columellar margin of the inner lip is very thin and straight, quite as Boas

1) p. 23.

says (p. 46, Pl. 3, figs. 33—34), only sometimes curved to the left. A strong rib, running on the bottom of the last whorl, so encircling the outer margin of the umbilicus, resembles somewhat a similar one in *L. helicina* (Sars, Pl. 29, figs. 1*b*—1*c*), though it does not at all project like a keel on the outer surface of the shell. A remarkable feature are the very conspicuous grooves, radiating from the umbilicus (fig. 3). Boas notes only a few spiral striae, encircling this umbilicus, of which I have failed to discover any trace, while the radial sculpture is most distinct.

The depressed spire, the wide umbilicus and the radial sculpture make this species closely resemble *L. helicina*. The more I regret not to have had any animal of *L. lesueuri* at my disposal, because, as Pelseneer (1888, p. 24) holds, this species is not provided with the small lobe on the anterior margin of the fin, which lobe on the other hand is most distinct in *L. helicina*.

Species 4. *Limacina retroversa* Fleming.
(Pl. 7, Figs. 4—5).

Animals:

Atlantic Ocean (Herlö, coast of Norway; 90 fathoms) September 22, '07, 22 sp., Dr. C. Popta.

Atlantic Ocean (Gulf of Biscay), June '06, extremely common, Buitendijk.

Most of the considerable numbers from the gulf of Biscay, in an excellent state of conservation, were young specimens (fig. 4), with a rather depressed spire, and only 4 whorls in the spire. The whole surface of the extremely thin and transparent shell is minutely and regularly striated in a spiral direction; this striation extends even to the aperture, where the equidistant lines are readily visible, also in adult specimens. While the height of the spire agrees with that of »*Spirialis retroversus*" Sars (p. 330, Pl. 29, fig. 3*a*) the striation is quite the same as in »*Spirialis balea*" of the same author. So the specimens from the gulf of Biscay form a gradual transition between the two species of Sars,

and are to be identified with "*Spirialis gouldi*" Stimpson. Though Pelseneer (1888, p. 29) already pointed out, that the specific distinctness of *L. balea* and *L. retroversa* could not be maintained, yet they are separated again by Locard (pp. 23—26), who on the other hand unites *L. trochiformis* with *L. retroversa*, which certainly are distinct species.

Furthermore I may draw attention to the fact, that a very small lobe on the dorsal margin of the fin occurs in all specimens, which lobe, as I have convinced myself, is also to be found in typical specimens of *L. retroversa*, from the coast of Norway. This lobe has hitherto not been stated in this species; it has only been found in *Limacina helicina* Phipps, *L. antarctica* Woodward and *L. australis* Souleyet. Now, *L. helicina* is distinctly bipolar (see Meisenheimer, p. 7 and map I), *L. antarctica* is most likely only a variety of this species in antarctic waters (Meisenheimer, l.c. p. 8). *L. australis* and *L. retroversa*, both with a raised spire, are respectively antarctic (notal) and bipolar. This group, provided with the fin-lobe, shows thus a clear tendency to the cold or temperate regions. The *Creseis virgula-acicula*-group, considered by all recent authors (except Schiemenz) to be the lowest Cavoliniidae, and next related to the Limacinidae (viz. to such species as are mentioned above) are strict inhabitants of tropic and subtropic waters, at least they do not extend beyond lat. 50° N. and 50° S. (with exception of a case mentioned by Schiemenz, p. 14, where *Creseis virgula* has been recorded from lat. 60° N. in the North-Atlantic). Perhaps this consideration may be of some importance with respect to phylogenetic speculations, especially because Meisenheimer (pp. 73—86) clearly pointed out that the Pteropoda originally are typical inhabitants of warm waters.

Species 5. *Limacina cochlostyloides*, n. sp.
(Pl. 7, Figs. 6—7).

Empty shells:

Indian Ocean (Gulf of Bengal), purchased 1907, 5 sp., Sowerby & Fulton.

Shell thin, quite transparent, colourless, left-handed; umbilicus very narrow; spire high, with obtuse summit; whorls $5^1/_2$, the last turn very large, occupying about $^2/_3$ of the shell; lips of the aperture very thin and fragile, aperture rounded, not angled; outer lip regularly curved, inner lip straight, projecting with a very thin margin over the umbilicus, and terminating in a short, pointed rostrum. Sculpture quite absent, only a few striae radiating from the umbilicus.

Height of the shell $1^1/_3$ mm.; maximum diameter 1 mm.

Operculum and animal unknown.

The specimens were obtained under the name »*Spirialis australis*" Souleyet. That they do not belong to this species is proved: 1° by the shallower suture, 2° by the different proportion in bulk of the last whorl to the foregoing in favour of the first, 3° the smaller aperture, nearly not projecting beyond the last whorl, 4° the pointed rostrum, 5° the narrow umbilicus, 6° the much more blunted apex, and 7° the smaller size, *L. australis* reaching a height of 2—2,5 mm.

The new species differs from *L. trochiformis* in the higher spire; moreover (and also from *L. bulimoides*) in the obtuse apex of the shell. It resembles, however, *L. retroversa* more closely than any other (cf. figs. 5 and 6). In this last species, on the other hand, the aperture is somewhat angled, owing to the irregular curving of the outer lip, while in *L. cochlostyloides* this curving is regular; the suture is much deeper in *L. retroversa*, and the very fine but clearly recognizable striation in spiral direction of this species is altogether wanting in *L. cochlostyloides*.

The new species belongs, in my opinion, to the group *australis-retroversa*, and shows much affinities with the latter. The habitat is in this respect most peculiar, as *L. australis* is typically antarctic, *L. retroversa* notal and boreal, viz. occurring in the temperate regions of both hemispheres (see especially Meisenheimer, p. 910), meanwhile the new species is recorded from tropical regions, the gulf of Bengal.

Species 6. *Limacina trochiformis* (d'Orbigny).

Animals:

Mediterranean,	June	'04, some sp.,	Buitendijk.
Indian Ocean,	February	'04, rather common,	"
"	May	'05, some sp.,	"
"	January	'06, many sp.,	"
"	April	'06, extremely common,	"
"	August	'06, some sp.,	"
"	Septemb.	'06, "	"
"	Novemb.	'06, "	"
"	July	'07, rather common,	"
" (Gulf of Bengal),	August	'06, "	"
" (Gulf of Aden),	Decemb.	'05, "	"
" ("),	August	'06, "	"
" ("),	March 17,	'07, "	"
Red Sea,	January	'05, "	"
"	January	'06, "	"
"	April	'06, "	"
"	Novemb.	'06, "	"
"	March 16,	'07, many sp.,	"
Malacca-street,	January	'06, some sp.,	"
"	August	'06, "	"
"	Novemb.	'06, "	"
Java-Sea,	May	'06, "	"
"	Decemb.	'06, "	"

Species 7. *Limacina bulimoides* (d'Orbigny).

Animals:

Indian Ocean,	May	'05, 1 sp.,	Buitendijk.
"	January	'06, 1 sp.,	"
"	April	'06, 1 sp.,	"
"	March	'07, 1 sp.,	"
"	July	'07, some sp.,	"
" (Gulf of Bengal),	August	'06, 1 sp.,	"
Red Sea,	January	'06, 1 sp.,	"

Genus 2. *Peraclis* Forbes (*emend.*).

Species 1. *Peraclis reticulata* (d'Orbigny).

Animals:

Indian Ocean, April '06, 1 sp., Buitendijk.

Empty shells:

Atlantic Ocean (Coast of Portugal, 1095 fathoms), 1906, H. B. Preston.

As Pelseneer (1888, p. 35) pointed out, the empty shells do not exhibit the reticulated sculpture as is seen in the shell of the living animal. I noticed that this reticulation is nearly quadrangular on the penultimate whorl and that an umbilicus scarcely exists. The only living specimen proved to be a young one by the extension of the reticulation on the last whorl, by its small size (2 mm.) and by the number of the whorls ($3^1/_2$). It belongs to the type, as the variety *minor*, established by me (p. 15, Pl. I, fig. 4), has at a size of 1,25 mm. already 4 whorls.

The empty shells, purchased from Mr. Preston under the name of *Peraclis diversa* Monterosato, really belong, in my opinion, to *P. reticulata*. We owe to A. Locard (p. 29, Pl. I, figs. 4—6) an accurate description, accompanied by figures, of the species of de Monterosato. From this description it appears that *P. diversa* is distinguished: 1° by the obliquely rolling up of its whorls, 2° by the suture, ornated with radiating, equidistant crests, 3° by the narrow and deep umbilicus. Now, the shells of Preston entirely agree with *P. reticulata*, the suture only exhibiting the above-mentioned crests; but as Meisenheimer (p. 12) remarked, *P. reticulata* shows exactly the same radiating crests. I failed to discover this feature in the shell from the Indian Ocean; nevertheless, as it may be a character dependent on age (Meisenheimer's specimens attained a height of 6 mm.), I feel justified myself in designating the specimens of Preston under the name of *P. reticulata*.

Family II. CAVOLINIIDAE.

Genus 1. *Creseis* Rang.

Species 1. *Creseis virgula* Rang.

Animals:

Mediterranean,	date?		some sp.,	Buitendijk.
"	May	'05,	"	"
"	Decemb.	'05,	"	"

Indian Ocean,	May	'05, many sp.,	Buitendijk.
"	January	'06, some sp.,	"
"	April	'06, rather common,	"
"	August	'06, some sp.,	"
"	Novemb.	'06, "	"
"	March	'07, many sp.,	"
"	July	'07, "	"
" (Gulf of Bengal),	August	'06, some sp.,	"
" (Gulf of Aden),	Decemb.	'05, "	"
" ("),	August	'06, "	"
Red Sea,	May	'05, some sp.,	"
"	January	'06, rather common,	"
"	April	'06, "	"
"	August	'06, many sp.,	"
"	Novemb.	'06, some sp.,	"
"	March 16,	'07, many sp.,	"
Malacca-street,	January	'06, some sp.,	"
"	Novemb.	'06, "	"
Java-Sea,	Decemb.	'06, many sp.,	"
"	August	'07, "	"

Most specimens belong to the very short, straight form *C. clava* Rang, which I believe to belong within the *virgula*-group. Only at a few places occurred the typical *C. virgula* with its markedly pronounced curvature. This form seems to grow to a rather large size, as it attains a length of 6 mm. Notwithstanding Schiemenz' recent assertions (p. 13) I cannot regard *C. conica* (Eschscholtz), which was maintained by Pelseneer, as a distinct species. It was found at many stations, especially in the Mediterranean and the Red Sea, but always mixed with *clava* and *virgula*, and indeed I have not been able to discover a single feature, which may decidedly separate *C. conica*. Formerly (p. 26) I exposed my views on this subject, agreeing nearly in this respect with Meisenheimer (p. 16).

Species 2. *Creseis acicula* Rang.

Animals:

Mediterranean,	date?,	rather common,	Buitendijk.
" (Sicily),	date?,	many sp.,	Cantraine.
"	June '04,	some sp.,	Buitendijk.

Mediterranean,	Decemb.	'05, some sp.,	Buitendijk.
Indian Ocean,	February	'04, "	"
"	May	'05, many sp.,	"
"	January	'06, some sp.,	"
"	April	'06, many sp.,	"
"	August	'06, some sp.,	"
"	Septemb.	'06, many sp.,	"
"	March	'07, "	"
"	July	'07, "	"
" (Gulf of Bengal),	August	'06, "	"
" (Gulf of Aden),	Decemb.	'05, some sp.,	"
" ("),	August	'06, many sp.,	"
Red Sea,	January	'04, some sp.,	"
"	Septemb.	'04, "	"
"	May	'05, "	"
"	January	'06, rather common,	"
"	April	'06, "	"
"	August	'06, some sp.,	"
"	Novemb.	'06, "	"
"	March 16,	'07, many sp.,	"
Malacca-street,	January	'06, some sp.,	"
"	August	'06, many sp.,	"
Java-Sea,	May	'06, rather common,	"
"	August—Sept.	'06, many sp.,	"
"	Decemb.	'06, "	"
"	August	'07, "	"

Empty shells:

Mediterranean (Sicily), date?, 6 sp., Cantraine.

I have referred to this species all the specimens with long, slender, straight shells. In a few cases the shell is however very slightly and irregularly curved, without exhibiting the least resemblance with the distinct and regular curvature as occurring in the typical *C. virgula*.

Genus 2. *Hyalocylix* Fol.

Species 1. *Hyalocylix striata* (Rang).

Animals:

Mediterranean (Sicily),	date?,	5 sp.,	Cantraine.
Indian Ocean,	August '06,	1 sp.,	Buitendijk.
Java-Sea,	May '06,	1 sp.,	"

Empty shells:

Mediterranean, date?, 2 sp., Cantraine.

Genus 3. *Styliola* Lesueur.

Species 1. *Styliola subula* (Quoy et Gaimard).

Animals:

Mediterranean,	date?,	10 sp.,	Cantraine.
"	date?,	5 sp.,	Buitendijk.
"	May '05,	4 sp.,	"
"	December '05,	6 sp.,	"

Empty shells:

Mediterranean (Sicily), date?, 4 sp., Cantraine.

The specimens, caught by Mr. Buitendijk, were nearly all young ones.

Genus 4. *Clio* Linné.

Species 1. *Clio balantium* (Rang).

Empty shell:

S. Atlantic Ocean, purchased 1907, 1 sp., Sowerby & Fulton.

This beautiful, large species which is easily to be distinguished by its flattened shape, its three dorsal longitudinal ribs and its marked transverse ridges, is certainly not the young stage of *Clio cuspidata* (Bosc), as Schiemenz believes (p. 16), as it grows to a much larger size, without ever assuming the characteristic features of the latter species.

The only specimen in the Museum has the posterior portion of the shell broken off; the straight part, which only exists, has a length of 22 mm.

Species 2. *Clio australis* (d'Orbigny).
(Pl. 7, Figs. 8—10).

Empty shells:

Australia, purchased 1907, 2 sp., Sowerby & Fulton.

The specimens are small, and reach a length of 6—7 mm. A very faint longitudinal rib runs dorsally, another, much broader, at the anterior ventral part of the shell, which is itself slightly depressed (fig. 10); the lateral ribs, rather conspicuous at the aperture, which is itself rounded, gradually disappear distally. The whole surface of the shell is provided with small ridges, thus giving it a great resemblance with that of *Hyalocylix striata* (Rang), from which it is otherwise distinguished by many characters. The whole shell is straight, not at all curved; the embryonic part is distinctly separated (fig. 9) and terminating into a point.

Pelseneer (1888, p. 62, Pl. II, fig. 8) holds, that the embryonic shell of this species is rounded, and for that reason very different from that of *Clio sulcata* (Pfeffer). I agree, however, with Boas (Pl. 4, fig. 46), who gave an accurate figure of the embryonic shell of *C. australis*. The little cup, in which it ends, may very easily be broken off, as indeed occurs in one of the two specimens in the collection of the Museum. In this respect, regarding the embryonic shell, *C. australis* and *C. sulcata* seem to agree entirely, though I am of opinion, like Pelseneer, that *C. sulcata* is quite a distinct species, contrary to Boas (p. 68).

Species 3. *Clio pyramidata* (Linné).

Animals:

Atlantic Ocean,	date?,		2 sp.,	?
N. Atlantic Ocean,	(46° N., 11° E.),	1878,	± 20 sp.,	R. J. Lusink.
"	(26° N., 20° E.),	1879,	4 sp.,	"
"	(25° N., 21° E.),	1879,	2 sp.,	"
"	(Bay of Biscay),	1904,	1 sp.,	Buitendijk.
"	(5° N., 24° E.),	1879,	1 sp.,	R. J. Lusink.
"	(4° N., 24° E.),	1878,	3 sp.,	"
S. Atlantic Ocean,	(14° S., 7° E.),	1878,	1 sp.,	"
Mediterranean,	date?,		± 35 sp.,	Cantraine.
" (Messina),	date?,		9 sp.,	"
Indian Ocean,	(32° S., 31° E.),	1878,	1 sp.,	R. J. Lusink.
"	(32° S., 34° E.),	1880,	1 sp.,	"
"	September '06,		1 sp.,	Buitendijk.

Red Sea,	May	'05,	rather common, Buitendijk.
"	January	'06,	some sp., "
"	April	'06,	" "

Empty shells:

Mediterranean (Sicily),	date?,	7 sp.,	Cantraine.
?	date?,	6 sp.,	?

Two varieties of this common and widely distributed species are present; the first: *angusta* Boas seeming to occur chiefly in temperate waters, the second: *lata* Boas confined to tropical and subtropical regions, though also living in the Mediterranean, from where no *angusta* is recorded, as far as is known to me. These varieties are, however, linked together by intermediate forms, nor can any great importance be attached to the distribution (which, according to Boas, is somewhat different from the one, indicated above), as f. i. the Siboga-expedition found both varieties in the Molucca Sea.

Species 4. *Clio cuspidata* (Bosc).

Animals:

Mediterranean,	date?,	± 10 sp.,	Cantraine.
" (Sicily),	date?,	14 sp.,	"

Empty shells:

Mediterranean (Sicily), date?, 4 sp., Cantraine.

Species 5. *Clio* sp. (juv.).
(Pl. 7, Figs. 11—13).

Animals:

Atlantic Ocean (Gulf of Biscay),	1904,	1 sp.,	Buitendijk.
Indian Ocean,	July '07,	2 sp.,	"

Shell minute (length 1,5 mm.), straight, transparent, quite colourless, surface transversely striated; aperture rather wide, dorsal margin (fig. 13) more convex than the ventral one, both without ribs; lateral sides flattened over almost

their entire length (fig. 12), rounded in the posterior third of the shell. Seen from the left or the right, the shell shows its sides markedly separated off from the rest (fig. 12), and not symmetrical but directed somewhat ventrally. Embryonic shell separated by a distinct constriction, proportionally large, pointed.

Animal with a bilobed fin and a short appendage on either side of the mantle.

I shall not bestow a name upon this form, as it is almost certainly a young stage. Nevertheless, it may be of importance to note that it cannot be referred, in my opinion, to any known species. The shape of the embryonic shell is much like that of *Clio cuspidata*, but here it is much more pointed. The flattened lateral sides indicate a species in which this flattening extends to the neighbourhood of the embryonic shell; and this, together with the shape of the last, suggests that it may be a young stage of *Clio balantium*, in which the longitudinal ribs and the characteristic transverse sculpture have not yet quite appeared. But the corresponding place of the adult shell of *C. balantium* shows the difference of being more high than broad in transverse section. There is also a great resemblance to *Clio chaptali* Souleyet, the nearest relative to *C. balantium*, but here the sides are not flattened, but sharply-keeled, and the whole shell is proportionally broader.

Genus 5. *Cuvierina* Bóas.

Species 1. *Cuvierina columnella* (Rang).

Animals:

Indian Ocean,	(14° S., 114° E.),	1880, 5 sp.,	R. J. Lusink.
"	(32° S., 42° E.),	1879. 1 sp.,	"

Empty shells:

N. Atlantic Ocean (Florida),	date?,	6 sp., H. B. Preston.
Japan,	date?,	1 sp., v. Siebold.
W. Pacific Ocean,	purchased 1907,	6 sp., Sowerby & Fulton.

The varieties described by Boas (p. 133, Pl. 6, fig. 95), *urceolaris* and *typica*, can scarcely be maintained, as the transitions between them are most gradual, and neither seems to inhabit special regions.

One of the specimens from the W. Pacific had the hinder part of the shell yet attached. It is long and slender, conic, terminating into a point, quite as Boas described it (p. 132, Pl. 3, fig. 39, Pl. 4, fig. 56). Contrary to this author, I could nothing observe about a constriction near the end, which separates an embryonic shell from the rest. At this place I observed a very minute septum, which, if I am not mistaken, also appears in the figure of Boas (Pl. 3, fig. 39), without being mentioned in the text. A similar, but much larger, transverse septum occurs, as is well known, somewhat behind the middle of the complete shell. The whole surface is very minutely striated, especially in transverse direction.

Genus 6. *Diacria* Gray.

Species 1. *Diacria trispinosa* (Lesueur).

Animals:

N. Atlantic Ocean, (5° N., 24° W.), 1879, 1 sp., R. J. Lusink.
" (4° N., 24° W.), 1880, 1 sp., "

Empty shells:

N. Atlantic Ocean, (24° N., 22° W.), 1880, 1 sp., R. J. Lusink.
Mediterranean (Sicily), date?, 1 sp., Cantraine.

Species 2. *Diacria quadridentata* (Lesueur).

Animals:

Indian Ocean, April '06, 1 sp., Buitendijk.
" (Gulf of Bengal), August '06, 1 sp., "

Empty shell:

Red Sea, 1861, 1 sp., Keferstein.

Genus 7. *Cavolinia* Abildgaard.

Species 1. *Cavolinia longirostris* (Lesueur).

Animals:

N. Atlantic Ocean,	(30° N., 36° W.),	1879,	9 sp.,	Kruisinga.
"	(26° N., 20° W.),	1878,	6 sp.,	R. J. Lusink.
"	(5° N., 24° W.),	1878, ± 40 sp.,		"
"	(4° N., 24° W.),	1878,	5 sp.,	"
"	(4° N., 28° W.),	1880, ± 40 sp.,		"
"	(2° N., 26° W.),	1880,	5 sp.,	"
Atlantic Ocean,	(0° N., 23° W.),	1879,	1 sp.,	Kruisinga.
S. Atlantic Ocean,	(1° S., 23° W.),	1879,	1 sp.,	"
"	(14° S., 7° W.),	1878,	2 sp.,	R. J. Lusink.
Indian Ocean,	(14° S., 114° E.),	1880,	1 sp.,	"
"	April '06,		1 sp.,	Buitendijk.
Java-Sea,	May '06,		2 sp.,	"

Empty shells:

Red Sea, 1861, 15 sp., Keferstein.
Japan, date?, 1 sp., v. Siebold.

Species 2. *Cavolinia tridentata* Forskål.

Animals:

S. Atlantic Ocean,	(14° S., 7° W.),	1878,	1 sp.,	R. J. Lusink.
"	(20° S., ?),	1880,	2 sp.,	"
Mediterranean,	date?,		19 sp.,	Cantraine.
" (Messina),	date?,		3 sp.,	Keferstein.
" (Naples),	1876,		5 sp.,	Dr. J. G. de Man.
Indian Ocean,	date?,		5 sp.,	Muller.

Empty shells:

Mediterranean (Messina), date?, 11 sp., Cantraine.
" (Leghorn), date?, 7 sp., "
Molucca Sea, date?, 2 sp., Muller.
(var. *affinis* Boas) S. Atl. Ocean, purchased 1907, 2 sp., Sowerby & Fulton.

Species 3. *Cavolinia uncinata* (Rang).

Animals:

N. Atlantic Ocean,	(5° N., 24° W.),	1879,	3 sp.,	R. J. Lusink.
"	(4° N., 26° W.),	1880,	3 sp.,	"

N. Atlantic Ocean, (2° N., 26° W.), 1880, 1 sp., R. J. Lusink.
S. Atlantic Ocean, (14° S., 7° W.), 1878, 1 sp., "
Mediterranean (Sicily), date?, 1 sp., Cantraine.

Species 4. *Cavolinia gibbosa* (Rang).

Animals:

N. Atlantic Ocean, (28° N., 20° W.), 1878, 3 sp., Kruisinga.
Mediterranean (Sicily), date?, 2 sp., Cantraine.
Indian Ocean, (32° S., 31° E.), 1878, 2 sp., R. J. Lusink.

Empty shells:

Mediterrancan (Sicily), date?, 2 sp., Cantraine.

Species 5. *Cavolinia globulosa* (Rang).

Animals:

Indian Ocean, (14° S., 114° E.), 1880, 2 sp., R. J. Lusink.

Species 6. *Cavolinia inflexa* (Lesueur).

Animals:

N. Atlantic Ocean, (5° N., 24° W.), 1879, 6 sp., R. J. Lusink.
" (2° N., 25° W.), 1879, 1 sp., "
" (2° N., 26° W.), 1880, 2 sp., "
S. Atlantic Ocean, (38° S., 18° W.), 1880, 1 sp., "
Indian Ocean, (14° S., 114° E.), 1880, 1 sp., "
" (32° S., 42° E.), 1879, 1 sp., "

Empty shells:

Mediterranean (Sicily), date?, 8 sp., Cantraine.

Quite as Meisenheimer stated (p. 37) for the material collected by the Valdivia-expedition, Boas' assertions that the variety *longa* is especially atlantic, the variety *lata* chiefly indian, are again confirmed by the collection of the Museum. Only the specimens from the Mediterranean belong partly to *lata*.

A few young stages of Cavoliniidae may also be recorded here:

» *Cleodora pygmaea*" Boas.

Animals:

Indian Ocean,	January	'06, some sp.,	Buitendijk.
"	August	'06, "	"
"	September	'06, 1 sp.,	"
"	November	'06, 1 sp.,	"
"	March	'07, 1 sp.,	"
Red Sea,	January	'05, 2 sp.,	"
"	January	'06, 4 sp.,	"
"	April	'06, some sp.,	"
"	August	'06, 1 sp.,	"
"	November	'06, rather common,	"

This form, which is doubtless a young stage, cannot, however, be referred with certainty to any known species. The embryonic shell, as well as the dorsal ribs, is most like that of *Diacria*. Perhaps it may be identified with *Diacria quadridentata*.

» *Cleodora compressa*" Souleyet.

Animals:

Indian Ocean, August '06, some sp., Buitendijk.

Almost certainly to be referred to *Diacria trispinosa*.

» *Hyalaea laevigata*" d'Orbigny.

Animals:

Indian Ocean, January '06, 2 sp., Buitendijk.
" April '06, 1 sp., "

Young stage of *Cavolinia longirostris*.

» *Pleuropus longifilis*" Troschel.

Animals:

Indian Ocean, March '07, 1 sp., Buitendijk.

Empty shell:

Mediterranean (Sicily), date?, 1 sp., Cantraine.

Young stage of *Cavolinia tridentata* (see especially Schiemenz, Pl. 1, figs. 1—7).

» *Hyalaea depressa*" d'Orbigny.

Animals:

N. Atlantic Ocean (Gulf of Biscay), June '06, rather common, Buitendijk.
" ("), Sept. '06, numerous, "
" (Coast of Portugal), March '06, rather common, "
Indian Ocean, April '06, 1 sp., "

This form corresponds certainly to *Cavolinia inflexa*. Contrary to Pelseneer (1888, p. 89) I regard » *Cleodora curvata*" Souleyet as a young, somewhat more advanced stage of *Cavolinia inflexa*, not of *C. uncinata*. This » *Cleodora*" is represented in the collection of the Museum by an empty shell from the South-Atlantic (Sowerby and Fulton, purchased 1907). The very marked and regular curvature, the great breadth of the aperture, and the comparative shortness of the shell, clearly indicate a species in which the posterior portion is strongly developed, and correspond, in my opinion, exactly with the variety *longa* of *C. inflexa*, in which the hinder portion of the shell is only somewhat more inflated on the ventral side. Remarkable is the fact that » *Cleodora curvata*" has hitherto only been found in the Atlantic. But this is exactly the region where *C. inflexa* var. *longa* lives.

B. PSEUDOTHECOSOMATA.

Family I. Cymbuliidae.

Genus 1. *Cymbulia* Péron et Lesueur.

Species 1. *Cymbulia peroni* de Blainville.

Animals:

Mediterranean (Naples), February '04, 3 sp., Dr. J. J. Tesch.

Some larvae, provided with shells and certainly belonging to *Cymbulia*, were caught:

N. Atlantic Ocean (Gulf of Biscay), 1904, 1 sp., Buitendijk.
Mediterranean, June '04, 1 sp., "
" May '05, 1 sp., "

Genus 2. *Gleba* Forskål.

Species 1. *Gleba cordata* Forskål.

Animals:

Mediterranean (Naples), 1904, 4 sp., Dr. J. J. Tesch.

Species 2. *Gleba* sp.

Animals:

Indian Ocean, (32° S., 52° E.), 1879, 2 sp., Kruisinga.

Two specimens, belonging to *Gleba*, but unfortunately severely damaged and deprived of their conchae, only recognizable by their long proboscis and five indentations on the margin of each fin.

They measure about 20 mm. across the fins.

A larva, within its shell, is to be referred to *Gleba*:

Mediterranean, date?, 1 sp., Buitendijk.

C. GYMNOSOMATA.

Family I. Pneumodermatidae.

Genus 1. *Pneumodermopsis* Bronn.

Species 1. *Pneumodermopsis* sp.

Larva:

N. Atlantic Ocean (Gulf of Biscay), June '06, 1 sp., P. J. Buitendijk.

A single specimen, in which the right gill is not yet completely developed; much contracted. Probably *Pn. ciliata* Gegenbaur. Length only 2,5 mm.

Genus 2. *Pneumoderma* Cuvier.

Species 1. *Pneumoderma violaceum* (d'Orbigny).

Mediterranean (Naples), March 1904, 2 sp., Dr. J. J. Tesch.

Two specimens, in a very good state of preservation. On each of the acetabuliferous appendages I counted 50—55 suckers, all small, and of about the same size mostly.

Species 2. *Pneumoderma peroni* (Lamarck).

Atlantic Ocean, date?, 6 sp., Boie.

The specimens are only badly preserved, and none of them has its acetabuliferous appendages stretched out. These are short, compressed and broad organs, and bear at the median side (lateral when retracted) about 80 (not 100, according to Boas and Pelseneer) small suckers, all of about the same size. They are provided with very extensible peduncles as Pelseneer (1887, p. 29) remarked: now a group of suckers at the dorsal margin of the appendage, now at the ventral margin or elsewhere, are strongly stretched out by means of long peduncles. This phenomenon becomes even yet more pronounced by the fact that the acetabuliferous appendage itself is composed of some longitudinal muscular bands, which can move rather independently of each other, and are often mutually in a very different state of contraction. So the whole may assume a variable shape, difficult to be described.

Family II. Clionidae.

Genus 1. *Clione* Pallas.

Species 1. *Clione limacina* (Phipps).

Groenland, date?, 5 sp., ?
Arctic Ocean, date?, 2 sp., cabinet Brugmans.

Remarks on distribution, inferred from the foregoing notes.

Vertical distribution. The Pteropoda are known to inhabit generally surface-waters, yet they seem to show an optimal horizon of 50 and more fathoms. Recently we have obtained some important dates about this fact by the investigations of Meisenheimer (p. 93), Pelseneer and G. H. Fowler (pp. 151, 154 and 155), and Schiemenz (pp. 28—30).

The investigations of Mr. Buitendijk indicate that

especially young specimens of Cavoliniidae occur at the surface (f. i. the catch of numerous »*Hyalaea depressa*" around the Spanish coast, while not a single adult *Cavolinia inflexa* was obtained). The most remarkable fact, however, is the occurring of *Peraclis* at the surface. I know not a single instance of its epiplanctonic existence. Only once (Pelseneer, 1906, p. 151) it was found, at night, at a depth of 30 fathoms, in the gulf of Biscay. In all other cases it has been signalized from depths of 100 fathoms and more.

Horizontal distribution. Most striking is the constant predominating of *L. trochiformis*, in comparison of *L. bulimoides*, in all the hauls of Mr. Buitendijk. All other authors regard *L. trochiformis* as a rather rare species, much less numerous than f. i. *L. inflata*. — Further the occurrence of *L. retroversa*, in considerable numbers at the surface, in the gulf of Biscay, is worth to be mentioned. From the same locality it has been recorded quite recently by Pelseneer (1906, p. 149), but only sparingly and at depths of at least 50 fathoms, with exception of one case at the surface.

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EXPLANATION OF PLATE 7.

Figs. 1—3. *Limacina lesueuri* (d'Orbigny).
" 4—5. *Limacina retroversa* Fleming.
" 6—7. *Limacina cochlostyloides*, n. sp.
" 8—10. *Clio australis* (d'Orbigny).
(Fig. 10 represents a transverse section of the shell near the aperture; *d* dorsal, *v* ventral side).
" 11—13. *Clio* sp. (? *balantium* Rang).
(Fig. 13. Same significance as in fig. 10).